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Research Article

A Study to Evaluate the Visual Outcomes and Complications of Surgical Management in Traumatic Cataract Cases

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Abstract
Purpose: To evaluate the visual outcomes and complications of surgical management in traumatic cataract cases at a tertiary care hospital.
Methods: A cross-sectional study was conducted on 66 patients with traumatic cataracts who underwent surgery. Preoperative assessment, surgical technique, postoperative visual acuity (VA), and complications were analyzed.
Results: Mean age was 32.5 ± 14.2 years, with 78.8% males. Postoperatively, 62.1% achieved VA ≥6/18, while 12.1% had VA <6/60. Posterior capsule rupture (28.8%) and zonular weakness (18.2%) were common intraoperative challenges. Posterior capsular opacification (15.2%) and glaucoma (9.1%) were notable postoperative complications.
Conclusion: Timely surgical intervention in traumatic cataracts yields good visual outcomes, though associated ocular injuries and complications impact prognosis. Individualized management is crucial for optimal results.

Keywords: Traumatic cataract, Visual outcome, Phacoemulsification, Primary intraocular lens implantation, Ocular trauma

INTRODUCTION

Traumatic cataracts represent a significant cause of preventable blindness, accounting for 5–20% of pediatric blindness worldwide and disproportionately affecting working-age adults, particularly males in occupational or high-risk settings[1]. Unlike age-related cataracts, which develop gradually, traumatic cataracts arise from acute mechanical, chemical, or radiation-induced lens damage, often complicating polytrauma scenarios[2]. The associated ocular injuries—such as corneal scars, zonular dehiscence, iridodialysis, vitreous prolapse, and retinal detachment—add layers of complexity to surgical management and long-term visual rehabilitation[3].

The mechanism of trauma (blunt vs. penetrating) heavily influences outcomes. Blunt trauma may cause capsular rupture or lens subluxation, while penetrating injuries introduce higher risks of infection (endophthalmitis) and secondary glaucoma[4]. In children, traumatic cataracts pose a unique challenge due to the critical period of visual development, where delayed intervention can lead to irreversible amblyopia[5]. Conversely, in severe trauma with coexisting ocular damage, a staged surgical approach may be necessary to allow inflammation to subside and anatomical structures to stabilize before lens extraction[6].

Surgically, phacoemulsification with primary IOL implantation remains the gold standard for isolated traumatic cataracts with intact zonular support[7]. However, cases with posterior segment involvement often require combined lensectomy, vitrectomy, and IOL placement—either in the bag, sulcus, or via scleral fixation[8]. Innovations in anterior segment imaging (AS-OCT, UBM) and intraoperative tools (capsular tension rings, iris hooks) have improved outcomes, yet visual prognosis remains highly variable, ranging from 20/20 to no light

perception, depending on associated retinal or optic nerve damage[9]. This study examines visual outcomes and complications of surgical management in traumatic cataract cases at a tertiary care hospital.

METHODOLOGY

Study Design and Setting

A hospital-based, cross-sectional study was conducted at Ophthalmology (RIO), Indira Gandhi Institute of Medical Sciences, Patna, from June 2021- May 2022.

Inclusion Criteria:

- Patients of all ages with traumatic cataracts (blunt or penetrating trauma).
- No prior intraocular surgery (except primary trauma repair).
- Minimum follow-up of 3 months postoperatively.

Exclusion Criteria:

- Pre-existing retinal/optic nerve pathology unrelated to trauma.
- Incomplete preoperative or follow-up data.

Preoperative Assessment

1. **Clinical Evaluation**:
   - Detailed **ocular history** (mechanism/time of trauma, prior interventions).
   - **Best-corrected visual acuity (BCVA)** (Snellen chart).
   - **Slit-lamp examination**: Lens status (capsular integrity, subluxation), corneal scars, anterior chamber reaction.
   - **Intraocular pressure (IOP)** measurement (Goldmann applanation tonometry).
2. **Imaging**:
   - **B-scan ultrasonography** if media opacity precluded fundus view.
   - **Anterior segment OCT** or **UBM** (where available) to assess zonular integrity.

Surgical Techniques

- **Standardized Approach**:
  - **Phacoemulsification** with in-the-bag IOL implantation for cases with intact capsular support.
  - **Lensectomy + anterior vitrectomy** for zonular instability or posterior capsule rupture.
  - **IOL Placement**:
    - In-the-bag (primary choice).
    - Sulcus-fixated or scleral-fixated IOLs if capsular support inadequate.
- **Combined Procedures**:
  - **Pars plana vitrectomy** (for vitreous hemorrhage/retinal detachment) performed by a vitreoretinal surgeon.

Postoperative Follow-up

Primary Outcome: Postoperative BCVA at 3 months (categorized as ≥6/18, 6/18–6/60, <6/60).

Secondary Outcomes:

- Intraoperative complications (e.g., posterior capsule rupture, zonular dialysis).
- Postoperative complications (e.g., PCO, glaucoma, cystoid macular edema).
- Refractive stability and IOL centration on slit-lamp examination.

Statistical Analysis

Data analyzed using **SPSS version 26** Descriptive statistics (mean ± SD for age, percentages for categorical variables). **Chi-square/Fisher's exact test** to compare outcomes by trauma type (blunt vs. penetrating).

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Total (n=66)	Percentage (%) or Mean ± SD
Age (years)	32.5 ± 14.2	–
Sex (Male)	52	78.8%
Mechanism of Trauma		
- Blunt injury	38	57.6%
- Penetrating injury	28	42.4%
Time to Surgery (weeks)	6.2 ± 3.8	–

Variable	Total (n=66)	Percentage (%) or Mean ± SD
Preoperative VA		
- ≥6/60	24	36.4%
- <6/60 to CF	32	48.5%
- HM/NLP	10	15.1%

The study population consisted of 66 patients with a mean age of 32.5 ± 14.2 years, showing a male predominance (78.8%). Blunt trauma (57.6%) was more common than penetrating injuries (42.4%). The average time from trauma to surgery was 6.2 ± 3.8 weeks, indicating delayed intervention in many cases. Preoperatively, 48.5% of patients had severely impaired vision (<6/60 to counting fingers), while 15.1% presented with hand motions or no light perception, reflecting the severity of trauma.

Table 2: Intraoperative Findings and Surgical Techniques

Variable	n	Percentage (%)
Surgical Technique		
- Phacoemulsification + IOL	45	68.2%
- Lensectomy + Vitrectomy	15	22.7%
- Scleral-fixated IOL	6	9.1%
Intraoperative Complications		
- Posterior capsule rupture	19	28.8%
- Zonular weakness/dehiscence	12	18.2%
- Vitreous loss	8	12.1%

Most patients (68.2%) underwent phacoemulsification with primary IOL implantation, while 22.7% required lensectomy combined with vitrectomy due to severe trauma. Scleral-fixated IOLs were used in 9.1% of cases with inadequate capsular support. Intraoperative complications were frequent, including posterior capsule rupture (28.8%), zonular weakness/dehiscence (18.2%), and vitreous loss (12.1%), highlighting the technical challenges in traumatic cataract surgery.

Table 3: Postoperative Visual Outcomes (3-Month Follow-up)

Postoperative VA	N	Percentage (%)
≥6/18	41	62.1%
6/18–6/60	17	25.8%
<6/60	8	12.1%

At 3 months post-surgery, 62.1% of patients achieved good visual acuity (≥6/18), correlating with isolated cataracts and absence of posterior segment damage. However, 12.1% had poor outcomes (<6/60), primarily due to retinal detachment or optic atrophy. Patients with intermediate vision (6/18–6/60, 25.8%) often had coexisting anterior segment pathology (e.g., corneal scars, mild PCO).

Table 4: Postoperative Complications

Complication	n	Percentage (%)
Posterior capsular opacification (PCO)	10	15.2%
Glaucoma	6	9.1%
Cystoid macular edema (CME)	4	6.1%
IOL decentration	3	4.5%

The most common complication was posterior capsular opacification (15.2%), managed successfully with YAG laser capsulotomy. Glaucoma (9.1%) and cystoid macular edema (6.1%) were also observed, requiring medical therapy or intravitreal interventions. Rare complications like IOL decentration (4.5%) necessitated surgical repositioning, underscoring the need for long-term monitoring.

DISCUSSION

This study evaluated the surgical management and outcomes of traumatic cataracts in a tertiary care setting, highlighting key demographic patterns, intraoperative challenges, visual outcomes, and postoperative complications. The findings provide valuable insights into the complexities of managing traumatic cataracts and underscore the importance of tailored surgical approaches based on the nature and severity of ocular trauma.

The study population predominantly comprised young males (78.8%), consistent with global trends where traumatic cataracts are more common in males due to occupational hazards, road accidents, and sports-related injuries[10]. The mean age of 32.5 years reflects the significant socioeconomic impact of traumatic cataracts, as this group represents the working-age population. Blunt trauma (57.6%) was more frequent than penetrating injuries, aligning with previous reports[11]. However, the mean delay of 6.2 weeks before surgical intervention suggests that many patients presented late, possibly due to delayed referrals or initial management of associated injuries. This delay may have implications for visual rehabilitation, particularly in children at risk of amblyopia[12].

Intraoperative complications such as posterior capsule rupture (28.8%) and zonular weakness (18.2%) were common, emphasizing the unpredictable nature of traumatic cataracts. These findings are consistent with studies reporting higher complication rates in trauma cases compared to age-related cataracts[13]. While phacoemulsification with IOL implantation was successful in most cases (68.2%), a significant proportion (22.7%) required lensectomy-vitrectomy, indicating the severity of trauma in these patients. The use of scleral-fixated IOLs (9.1%) further highlights the challenges in cases with inadequate capsular support. These results reinforce the

need for preoperative imaging (AS-OCT, UBM) to assess zonular integrity and plan surgical strategies accordingly[14]. Postoperatively, 62.1% of patients achieved good visual acuity (≥6/18), comparable to outcomes reported in other trauma studies[15]. However, 12.1% had poor vision (<6/60), primarily due to retinal detachment, optic atrophy, or corneal scarring. These findings align with evidence suggesting that posterior segment involvement is the most critical determinant of final visual prognosis[16]. The intermediate visual outcomes (6/18–6/60) in 25.8% of cases were often associated with anterior segment pathology, reinforcing the need for combined anterior and posterior segment evaluation in traumatic cataracts. The most frequent complication was posterior capsular opacification (15.2%), managed effectively with YAG laser capsulotomy. Glaucoma (9.1%) and cystoid macular edema (6.1%) were also observed, consistent with previous studies linking trauma to secondary glaucoma and inflammation[17]. While most complications were managed medically, IOL decentration (4.5%) required surgical intervention, underscoring the importance of long-term follow-up in these patients.

CONCLUSION

Despite surgical challenges, most patients with traumatic cataracts achieved functional vision. However, associated ocular injuries significantly influenced outcomes, emphasizing the need for individualized treatment plans and comprehensive preoperative assessment. Future research should focus on standardized protocols for timing and surgical techniques to optimize visual rehabilitation

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